Fact Sheet

AIRCRAFT IN-FLIGHT ICING

PROBLEM

In-flight icing is a persistent problem for aviation. Icing of aerodynamic surfaces from cloud droplets, freezing drizzle, and freezing rain threatens all classes of aircraft, including those with ice protection. At greatest risk are aircraft without ice protection and those that fly at relatively low altitudes and slow speeds, such as helicopters and turboprops. Because icing forecasts are unable to predict aircraft icing severity with high spatial and temporal resolution, some aircraft cannot fly in areas forecast for icing, even though hazardous icing may occur within only a small area of the forecast region at any one time. Better methods are needed to allow aircraft to avoid and exit hazardous in-flight icing conditions.

SOLUTION

Several approaches may lessen the impact of in-flight icing. One approach is to remotely detect, measure, and map the magnitude of conditions causing icing ahead of aircraft in flight. Analogous to airborne weather radar and wind shear detection systems, an aircraft-mounted or ground-based system tailored to remotely map cloud liquid water content, drop size, and temperature would allow pilots to avoid and exit potentially hazardous icing areas. CRREL, in partnership with the NASA Lewis Research Center Icing Branch and the FAA William J. Hughes Technical Center, is developing radar and microwave radiometer-based systems for remotely measuring icing conditions from the ground or from the air through Small Business Innovation Research (SBIR), Small Business Tech Transfer Research (STTR), and direct-funded research. Other agencies and university and industry groups are also involved. The goal is to demonstrate a ground-based system within five years and an airborne system within ten years.

CRREL has also developed, through the SBIR program and in partnership with the National Center for Atmospheric Research (NCAR), a radiosonde that measures the magnitude of supercooled liquid water with height through clouds. If used systematically, the instrument could improve icing forecasts by providing supercooled liquid water measurements for aviation forecast models. CRREL is also working with Dartmouth College to assess the use of electrical currents to reduce the bond strength of ice to helicopter blades.

RESULTS

A joint NASA/CRREL/FAA conference was held to assess the operational, meteorological, and instrumentation requirements for remotely detecting icing conditions. Feasibility studies conducted by university and industry groups to assess the capability of radar and microwave radiometers to map icing conditions (funded by CRREL SBIRs, NASA, and the FAA, and monitored by CRREL) have been completed. Various proceedings papers have been published on this work. A comprehensive assessment of these studies, the Mount Washington Icing Sensors Project (MWISP), is being conducted in April 1999, directed by NCAR and co-directed by CRREL.

The icing radiosonde has been assessed against inflight instrumented aircraft measurements by CRREL and NCAR, and the results have been published in journals. The radiosonde is being commercialized, and a drop-size sonde is being developed under CRREL and NCAR sponsorship. CRREL and Dartmouth College are assessing electrical effects on ice bond strength for natural ice, and CRREL is assessing the spatial properties of cloud icing conditions with NASA.

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